US LHC ACCELERATOR PROJECT

brookhaven - fermilab - berkeley

US LHC Accelerator Research Program

Jim Strait
Fermilab

DOE Review

15 October 2003

US LHC Accelerator Research Program

brookhaven - fermilab - berkeley

Goals of the US LARP

Advance High Energy Physics

- Help bring the LHC on and up to design performance quickly.
- Improve LHC performance by advances in understanding and instrumentation.
- Use LHC as a tool to gain deeper knowledge of accelerator science and technology.
- Extend LHC as a frontier HEP instrument with a timely luminosity upgrade.

Advance U.S. Accelerator Science and Technology

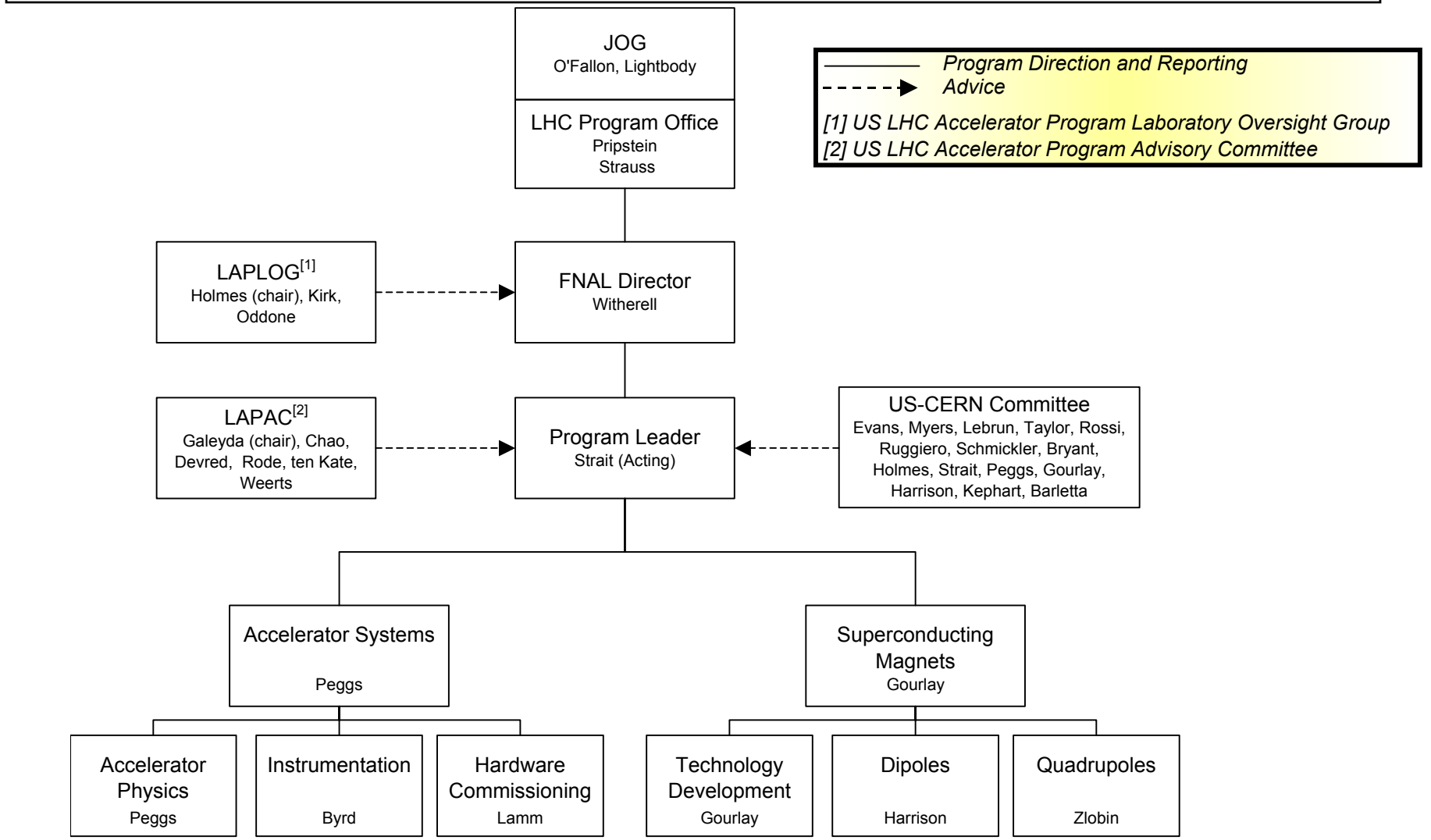
- Keep skills sharp by helping commission the LHC.
- Conduct forefront AP research and development.
- Advance U.S. capabilities to improve the performance of our own machines.
- Prepare U.S. scientists to design the next generation hadron collider.
- Develop technologies necessary for the next generation of hadron colliders.

Advance International Cooperation in the High Energy Accelerators

Overview of the Technical Program

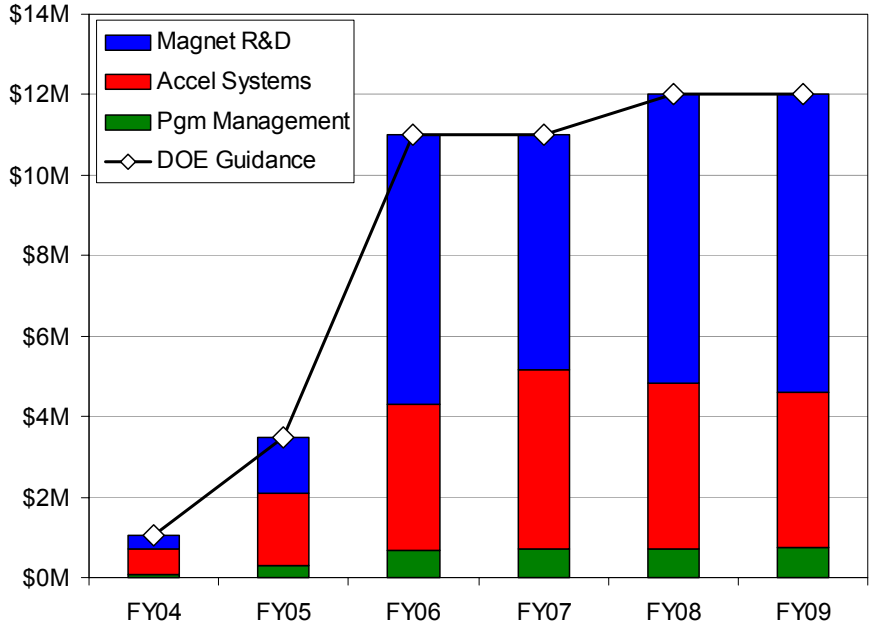
- Help commission the hardware delivered by the US LHC Accelerator Project and later by the LARP
- Help commission the LHC with initial beam.
- Develop and build new instruments that will improve the operation of the LHC and help us perform accelerator physics experiments.
- Use the LHC to perform experiments and test calculations and theories of fundamental accelerator science.
- Perform accelerator physics studies and advanced magnet R&D that will result in the IR designs and prototype IR magnets for a timely LHC luminosity upgrade.

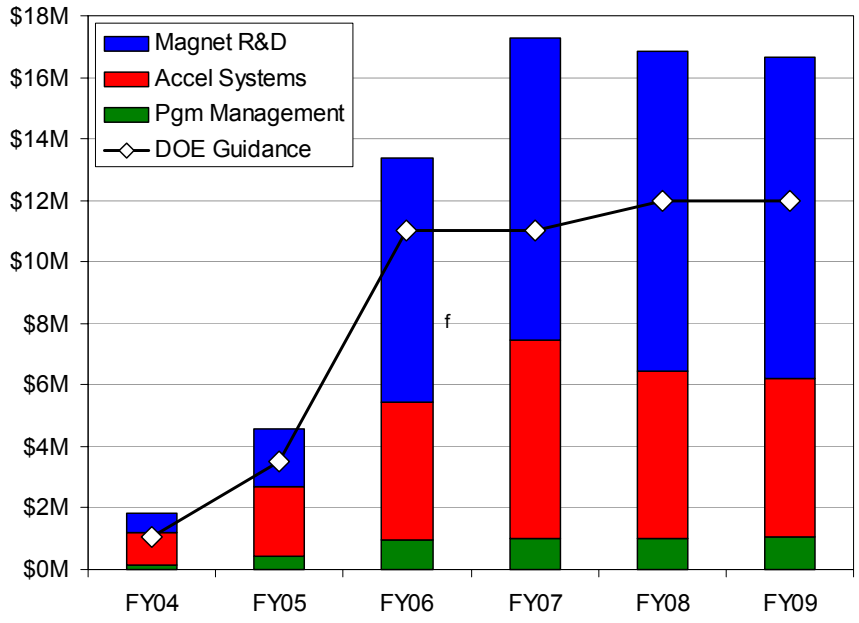
Organization and Management



LARP Proposal and Lehman Review

- Formal Proposal submitted to DOE on 28 May 2003, for program consistent with funding guidance.
- Draft proposal for an “enhanced” program submitted on 6 June 2003.





- Lehman Review 10-11 June 2003 recommended approval of the LARP at the funding guidance level.

Lehman Review Report

EXECUTIVE SUMMARY

This report summarizes the conclusions of the review of the proposed LHC Accelerator Research Program conducted on June 10-11, 2003. The program is intended to exploit the technology and experience developed in the current LHC Accelerator Construction Program by teams at three Department of Energy High Energy Physics laboratories. The Committee found the proposed work plan was sound, made good use of the personnel at the three labs, and moved the accelerator technology base of the United States in a positive direction. The committee endorsed the program and recommended funding at the guidance levels consistent with the specific recommendations within this report.

The Committee encouraged the program to broaden participation to include expertise both in the University community and at other laboratories where appropriate. In addition, the Committee suggested that DOE review the progress and plans of the program next year.

Planning the FY2004 Program Details:
Collaboration Meeting 16-18 September 2003

FY2004 Budget Submitted to DOE
July 2003

Program Total	1050
BNL	330
FNAL	329
LBNL	391
Acc Syst	637
BNL	203
FNAL	185
LBNL	249
Magnet R&D	325
BNL	105
FNAL	100
LBNL	120
Pgm Mgmt	88
BNL	22
FNAL	44
LBNL	22

Acc Syst	637
BNL	203
FNAL	185
LBNL	249
Instrumentation	300
BNL	69
FNAL	69
LBNL	162
Acc Phys	227
BNL	101
FNAL	72
LBNL	54
Hdw Comm	110
BNL	33
FNAL	44
LBNL	33

LARP Collab Mtg - 16 Sep 03 Meeting Objectives - J. Strait 9

FY04 Labor Breakdown

- Heat Transfer
  - Analysis — BNL 0.2 S/E
  - Studies — BNL 0.1 S/E, FNAL 0.1 S/E, LBNL 0.2 S/E, 0.2 D/T
- Quad Design — FNAL 0.2 S/E
- Dipole mechanical structure — BNL 0.2 S/E
- Cable studies — FNAL 0.1 S/E, 0.1 D/T; LBNL 0.1 S/E, 0.1 D/T

Labor Summary

	S/E	D/T
BNL	0.5	0.0
FNAL	0.4	0.1
LBNL	0.3	0.3
Total	1.2	0.4

LARP Collaboration Meeting September 18, 2003

S. Gourlay

Initial Instrumentation

"We should integrate Accelerator Physics and Instrumentation Physics activities, as far as possible"

Need to establish "Task Sheets"

1) Tune and Chromaticity Feedback

- separate studies at BNL & FNAL for 2 years, then make a technology choice
- multiple oscillators?
- control room cognoscenti assert that this will be a critical commissioning and (early) operational tool ...

Initial Instrumentation

2) Luminosity Monitor

- build eight 4-channel devices in FY2005-2006

- 40 Mhz demonstration is essential in FY04, eg for technology choice (CdTe)

- evaluate compatibility with ZDC lumimonitors

University of Kansas intitiative.

Initial Instrumentation

3) Longitudinal Density Monitoring

Not in baseline plan until FY05, but CERN made a ***strong*** argument to start ***now***.

1) Abort Gap Monitor

- simple, robust, dedicated, reliable
- critical (even early) for Machine Protection System

2) Optical Sampling System

- very powerful and sexy as a tool to study longitudinal beam dynamics, eg tomography, diffusion, ...
- state-of-the-art, complex, multi-purpose

Are these 2 devices "one and the same"?
Review by Machine Protection Committee?

Beam Commissioning

TI8 test with beam	Sept	2004 !
Commissioning sector 7-8	May	2005
Injection test with beam	April	2006
TI2 commissioning	April	2007
LHC commissioning	April	2007 ->

Consistent with this schedule – NOW (FY04) - establish WHAT "1 US physicist on every control room shift" means, and HOW to do it ....

Accelerator Physics Topics

Interaction region optics and error compensation
- For baseline IR's
- Studies for luminosity upgrade.

Electron cloud simulations and measurements.

Beam-beam calculations.
- Studies of compensation methods: wires or electron lens.
- Existing collaborations with UNM and U of Kansas.

Energy depositon and collimation studies.
- For baseline LHC configuration.
- For luminosity upgrade, especially IR design.

All carried out at a minimal level due to limited funding.

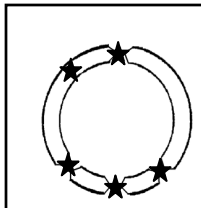
Additional Collaboration Possibilities

The Lehman Review Committee strongly recommended that we expand the LARP collaboration to include universities and other labs.

(Where will the funding come from for the new collaborators?)

We have take early steps in this direction:

- Collaborations already exist with UNM and U of Kansas on beam-beam interactions.
- Preliminary discussions have occurred with Cornell.
- Michael Murray (U of Kansas) participated in LARP Collaboration Meeting to discuss coordination luminometers with ZDCs at IR5.
- Discussion with universities of the Illinois Coalition for Accelerator Research are planned.
- SLAC personnel have developed a proposal to work on the LHC collimation system.



NLC - The Next Linear Collider Project

Guesstimated TimeLine & Resource Requirements

2004	2005	2006	2007	2008
Coupon Tests COLWAKE	Coupon Tests COLWAKE	X	X	X
Finish P0 Specifcations ·Lattice ·Materials	Design P1 Build P1 Test P1 Design P2 Build P2	Test P2 Design P3 Build P3	Build P3 Test P3 Design P4 Build P4	Construct 5-10 Collimators
$75k M&S + Shop	$25K+125k+ 75k=$225k	$400k	$500k	$100k/each
0.5 ME 0.5 SLAC P 0.25 FNAL P	1.0 ME 0.5 SLAC P 0.25 FNAL P 1 M. Des.	1.0 ME 0.5 SLAC P o.25 CTRLS 1 M. Des.	1.0 ME 0.5 SLAC P o.25 CTRLS 1 M. Des.	Tom Markiewicz

NLC - The Next Linear Collider Project

LHC Collimator R&D

Eric Doyle, Josef Frisch, Tom Markiewicz, Tor Raubenheimer
SLAC

LARP
Port Jefferson NY
17 September 2003

Recent Developments

- Video meeting of US-CERN yesterday to discuss FY2004 plan that was developed at September Collaboration Meeting.
- "Task Sheets" being written to define yearly work on each of 12 tasks.
- DOE has offerred additional $200k for FY2004, which can allow early start of LDM R&D and facilitate SLAC's entry into collaboration.
- DOE has suggested that modest additional FY2004 funding may be available to start a LARP associated university program.
  - We are starting to explore possibilities with potential collaborators.
  - Considering the LCRD and UCLC programs as models

FY 2004 Budget

10/8/2003

"WBS"		US LARP FY2004 Budget FTE	M&S (k$)	Total (k$)	BNL	FNAL	LBNL	SLAC	
	Totals	5.7	141	1250	330	329	471	120	
	Beams Div				170	141	296		
	Magnet Div				160	188	175		
1	Accelerator Systems	3.7	107	837	203	185	329	120	
1.1	Instrumentation	1.5	82	380	69	69	242	0	
1.1.1	Tune feedback	0.5	41	138	69	69			**Cameron** / Marriner
1.1.2	Luminometer	0.6	41	162			162		**Byrd**
1.1.3	LDM	0.4		*80*			*80*		**Byrd**
1.2.1	AP	1.5	15	181	55	72	54		**Peggs** / Sen / Furman
1.2.2	BC	0.2	2	46	46				**Peggs**
1.3	Collimation			*120*				*120*	**Markiewicz**
1.4	Hdw Comm	0.5	8	110	33	44	33		Wanderer / **Lamm** / Rasson
2	Magnet R&D	1.6	29	325	105	100	120		
2.1	Technology Dev	1.2	29	245	65	60	120		Gupta / Zlobin / **Gourlay**
2.2	Quad design	0.2		40		40			**Zlobin**
2.3	Dipole design	0.2		40	40				**Anerella**
3	Program Management	0.4	5	88	22	44	22		Harrison / **Strait /** Gourlay

US LARP Summary

The US LHC Accelerator Research Program has been launched.

- Lehman Review approved the proposed program.
- Collaboration meeting last montf to make detailed plan for FY2004 (and beyond).
- Meeting of US-CERN Committee yesterday discussed FY2004 plan.
- Exploring opportunities to expand the collaboration, most notably the proposed participation by SLAC.